

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



February 29, 2016

MATERIALS LABORATORY FACTUAL REPORT

Report No. 16-004

A. ACCIDENT INFORMATION

Place : Plainview, Illinois
Date : October 26, 2014
Vehicle : Sonex HB, N244HB
NTSB No. : CEN15LA028
Investigator : Mitchell Gallo, ASI-CEN

B. COMPONENTS EXAMINED

- 1) Fractured crankshaft in two pieces;
- 2) Fractured camshaft in two pieces.

C. DETAILS OF THE EXAMINATION

A fractured crankshaft and fractured camshaft from a Great Plains Aircraft Supply kit engine were sent to the NTSB Materials Laboratory for examination, as shown in figures 1a and 1b. The crankshaft was fractured through the forward cheek of the number 2 main bearing (with numbering starting from the aft end of the engine). The camshaft was fractured between the number 1 and number 2 lobes (with numbering starting from the aft end of the engine). Notable entries in the aircraft logbook are shown in table 1.

The crankshaft fracture surface was examined visually and one half of the fracture was photographed as shown in figures 2a and 2b. The fracture surface was comparatively flat and exhibited a series of curved crack arrest marks. The features were consistent with a fatigue crack initiating at the intersection of the number 2 main bearing journal with the forward cheek, as indicated in figure 2b.

Visual examination revealed that the transition from the journal to the cheek consisted of a small radius fillet that blended into a large radius fillet, as indicated in figure 3a. The journal was sectioned through the transition with an abrasive cutting saw and photographed, as shown in figure 3b. The radius of each fillet was measured on the calibrated digital image. The fillet radii were approximately 0.090 inch and 0.014 inch for the large and small radius fillets, respectively. The transition from the number 2 journal to its aft cheek and the number 1 journal to its forward cheek similarly exhibited small diameter and large diameter fillet radii, as shown in figures 4a and 4b, respectively.

While sectioning the number 2 journal, the counterweight forward of the number 2 main journal, labelled in figure 1a, was also sectioned. The counterweights were made from arc-shaped pieces of steel welded to the crankshaft. Welds were applied on both the forward and aft faces of the counterweights and the crown of each weld was removed to be flush with the face of the counterweight. The sectioned piece of counterweight is shown from two directions in figures 5a and 5b. The welds penetrated through approximately 42% and 30% of the wall thickness in figures 5a and 5b, respectively.

The chemical composition of the crankshaft was measured using a handheld X-ray fluorescence spectrometer. The composition of the crankshaft was consistent with a plain carbon steel.

Donald Kramer, Ph.D.
Sr. Materials Engineer

Table 1: Notable events from the aircraft logbook.

Date	Total Time, hrs	Event
March 20, 2010	0	Engine installed on airplane.
November 20, 2011	222.08	Remove engine, replace lifters and cam, lap valves.
July 1, 2012	222.08	Break in cam and lifters.
August 10, 2014	300.4	Last inspection prior to accident.

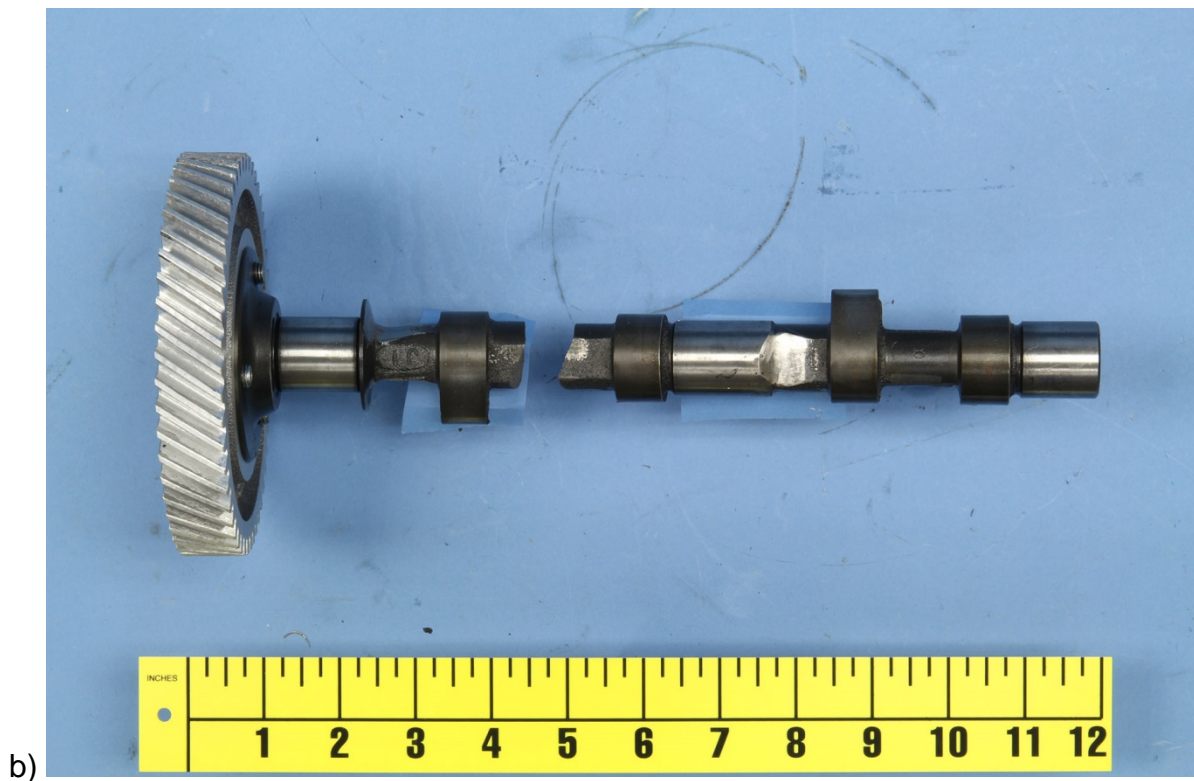
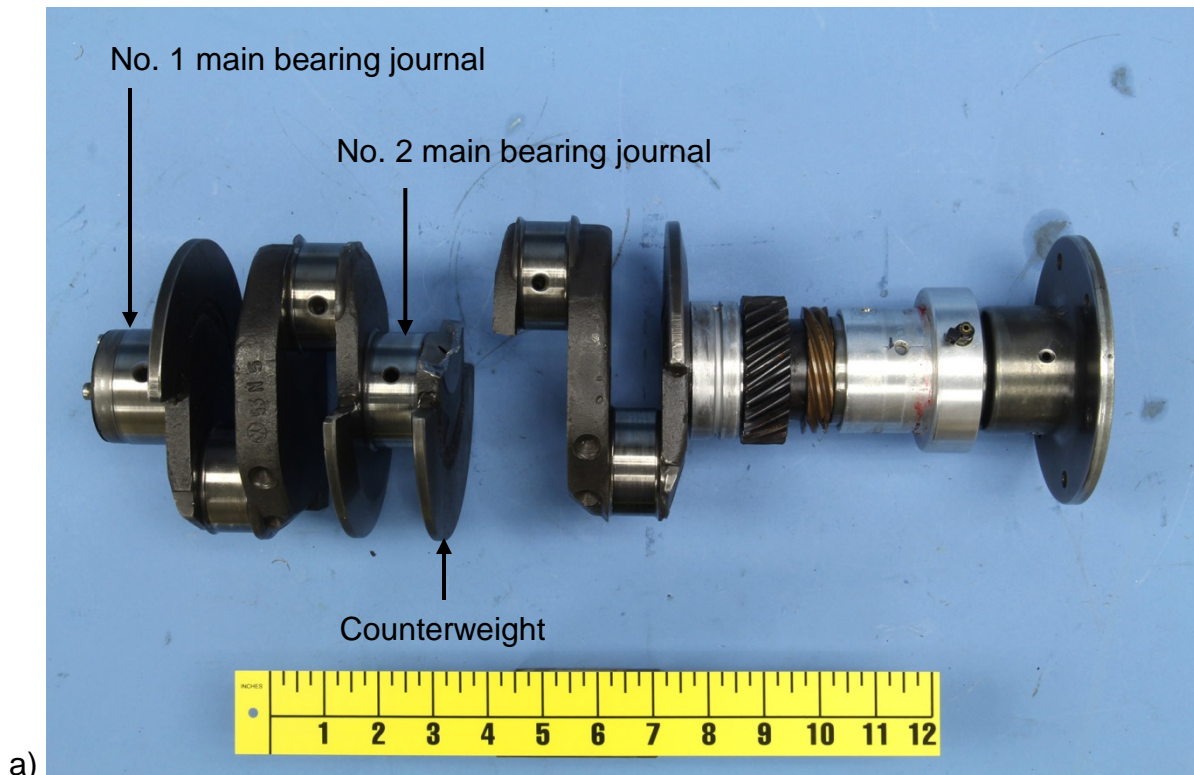


Figure 1: a) Image of the fractured crankshaft, as received; b) Image of the fractured camshaft, as received.

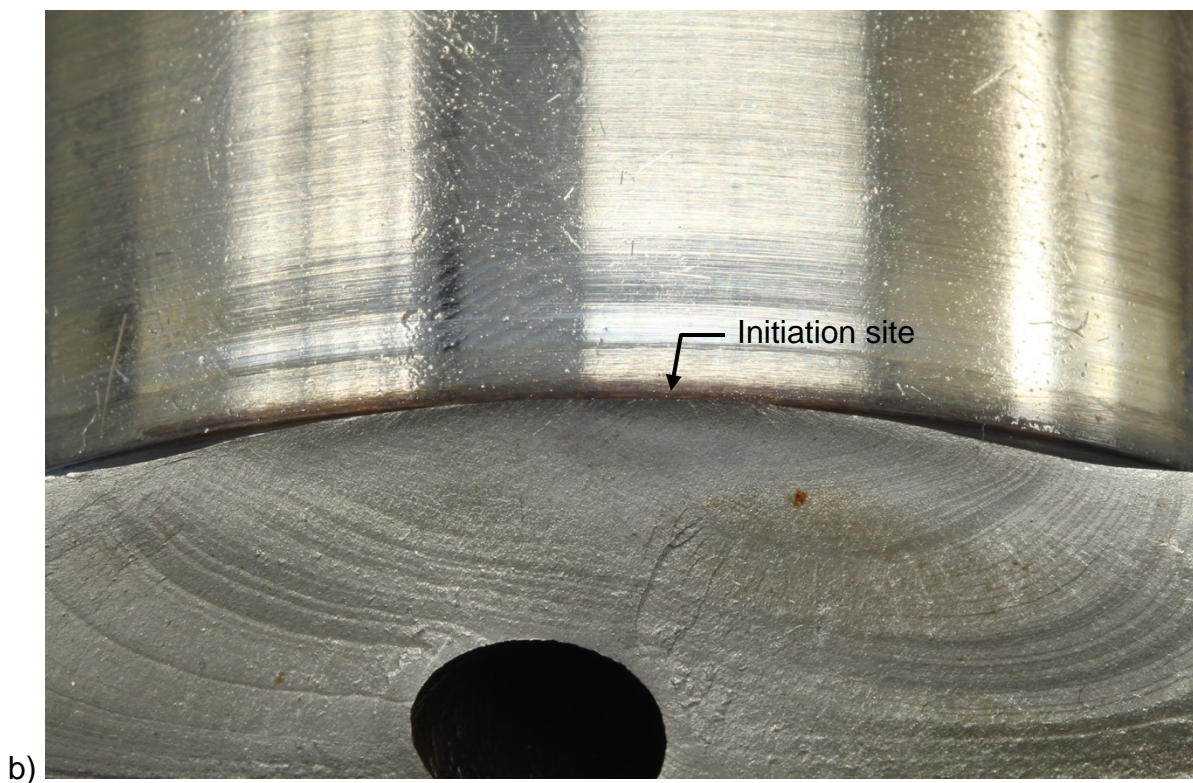
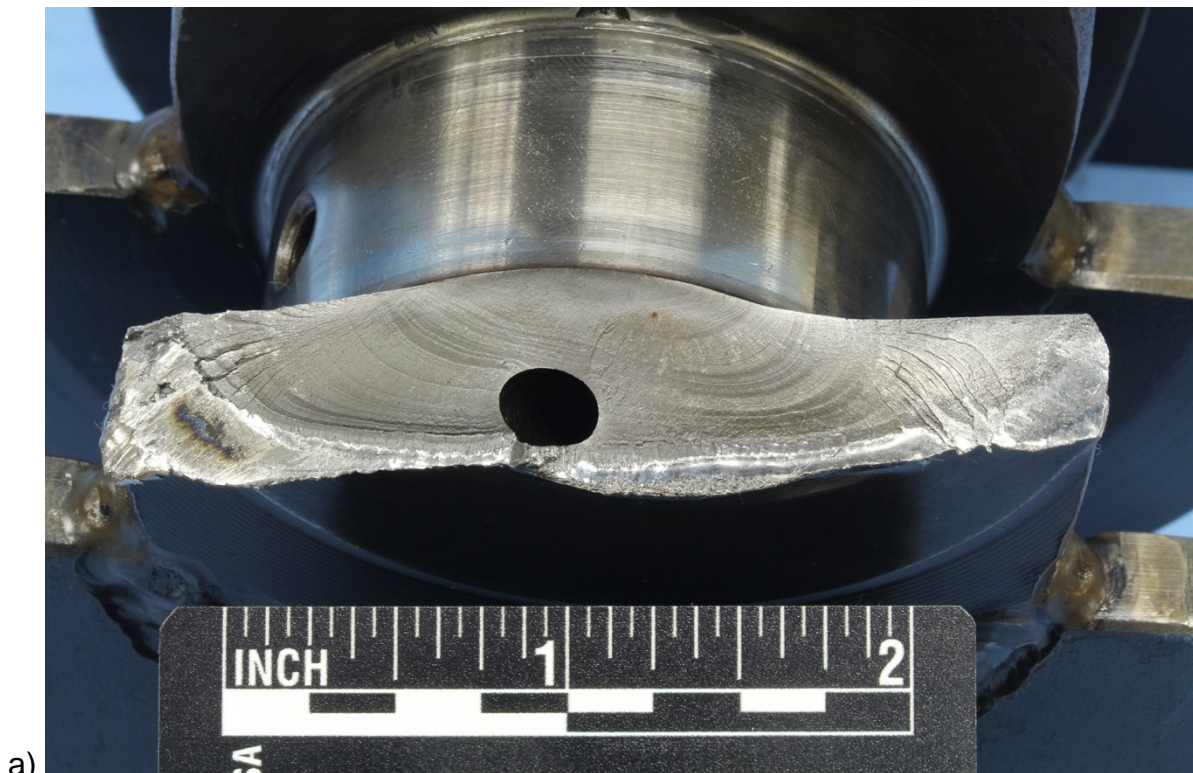


Figure 2: a) Image of the fractured cheek forward of the number 2 main bearing journal; b) Higher magnification image of the fracture indicating the initiation site.

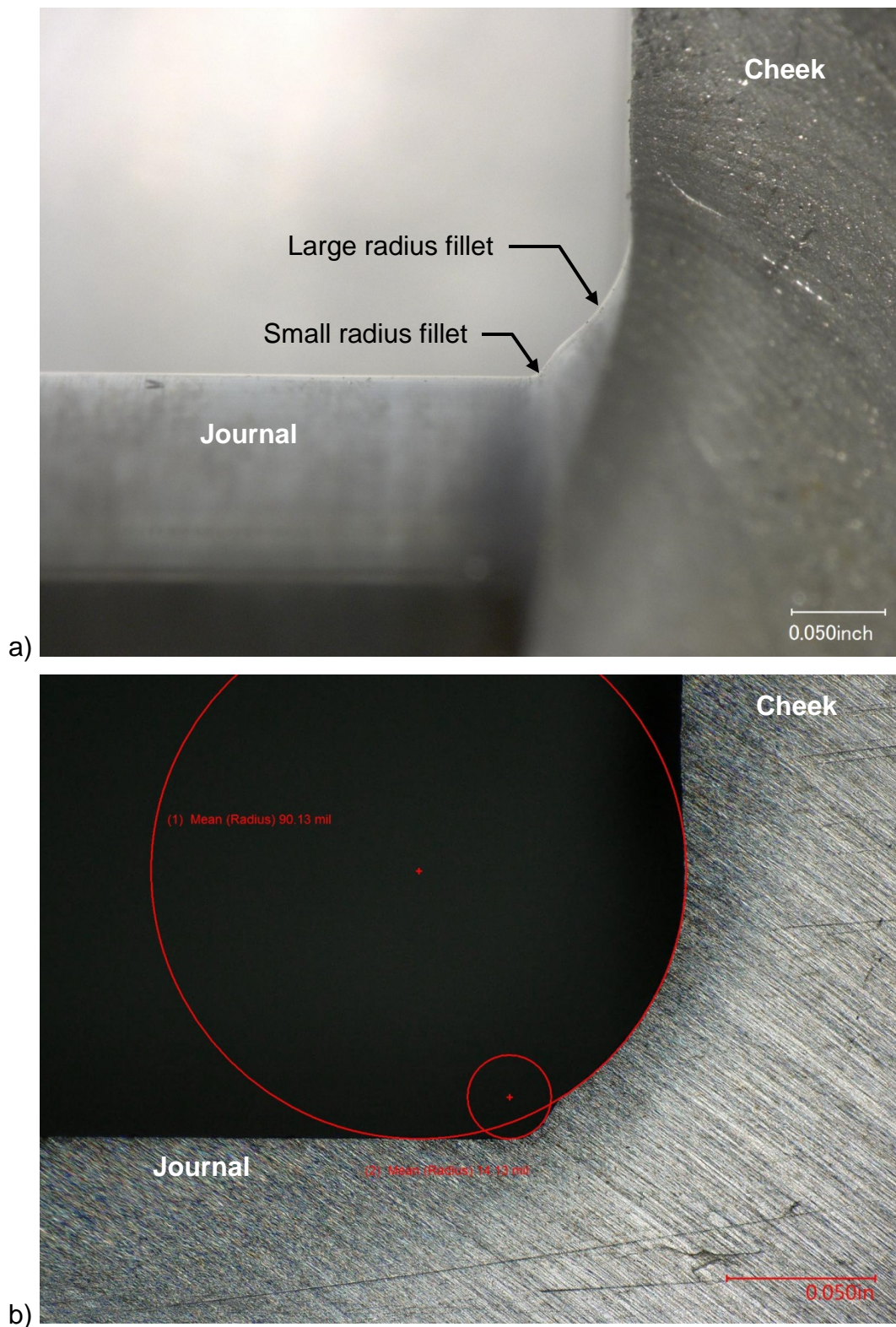


Figure 3: a) Image of the journal to cheek fillet at the forward edge of the number 2 main bearing journal; b) Section through the journal used to measure the size of the large and small radii.

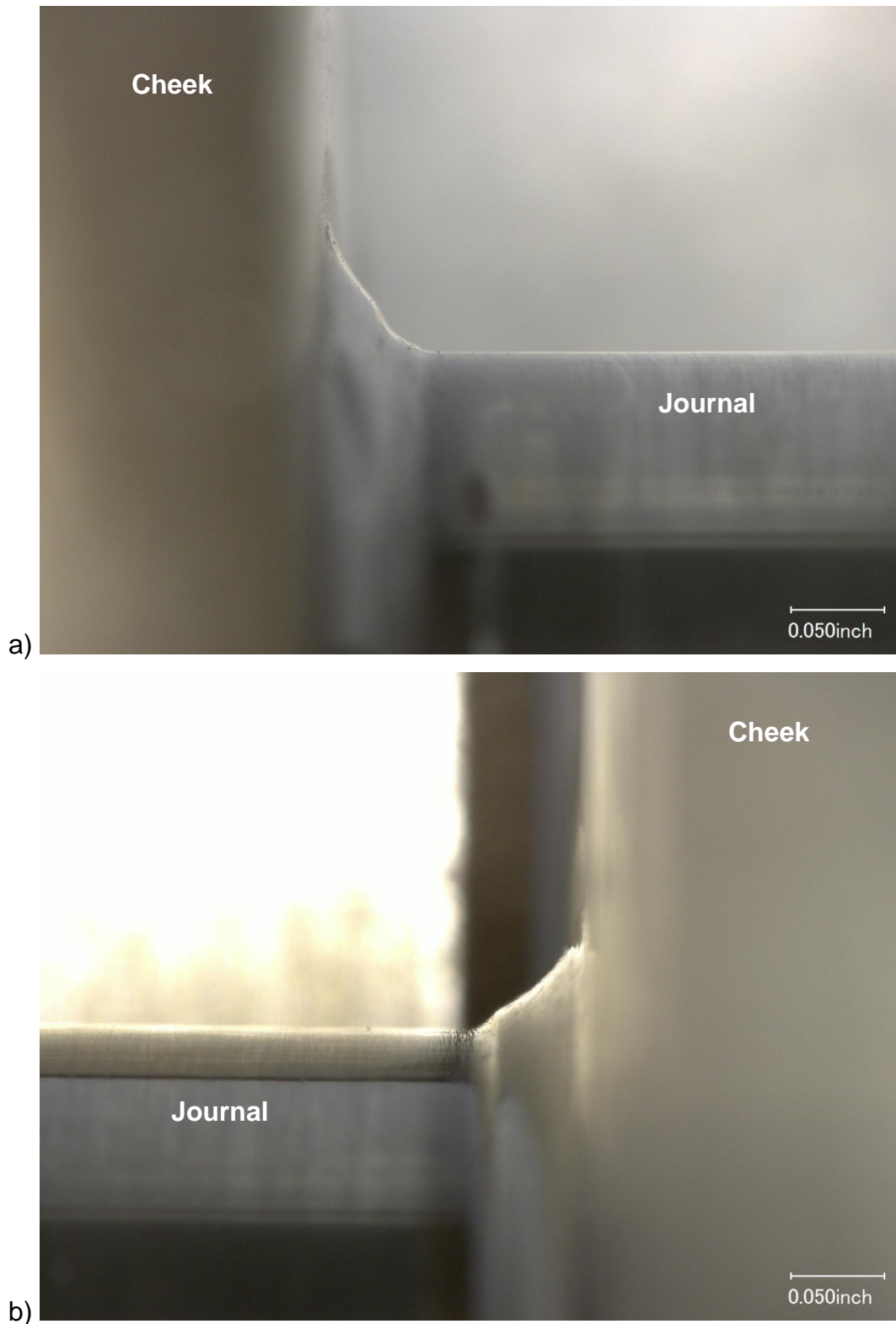
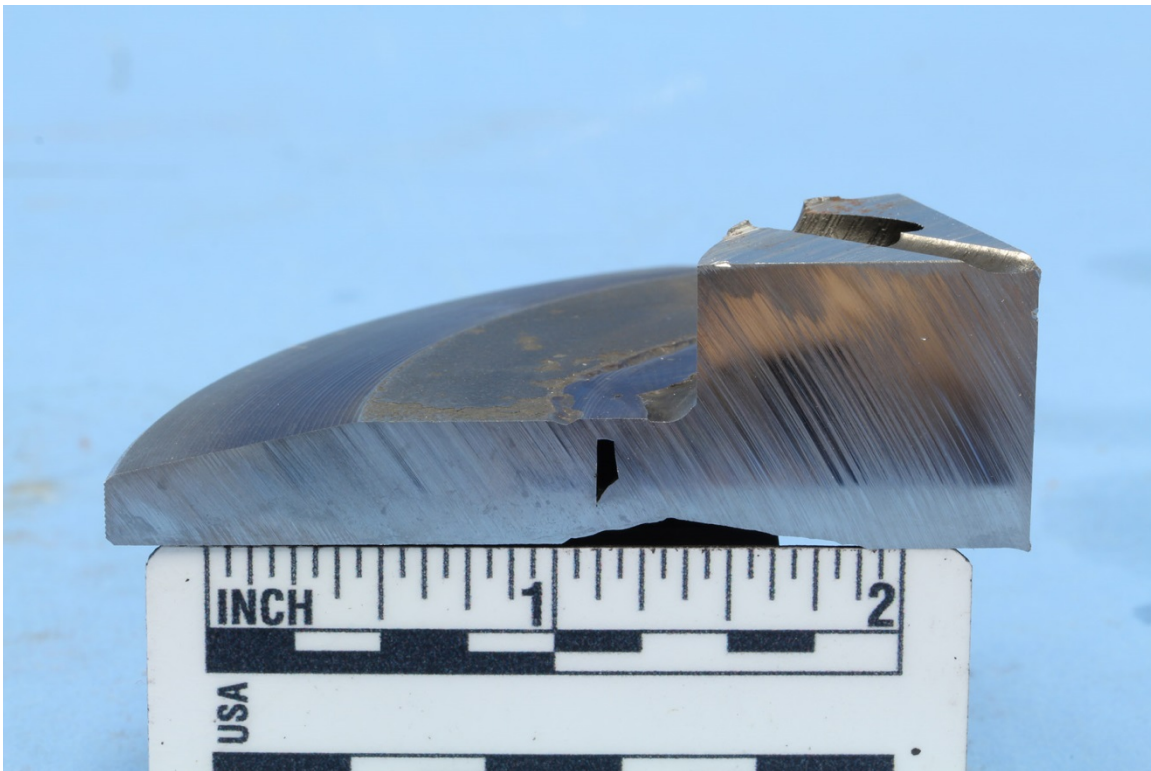
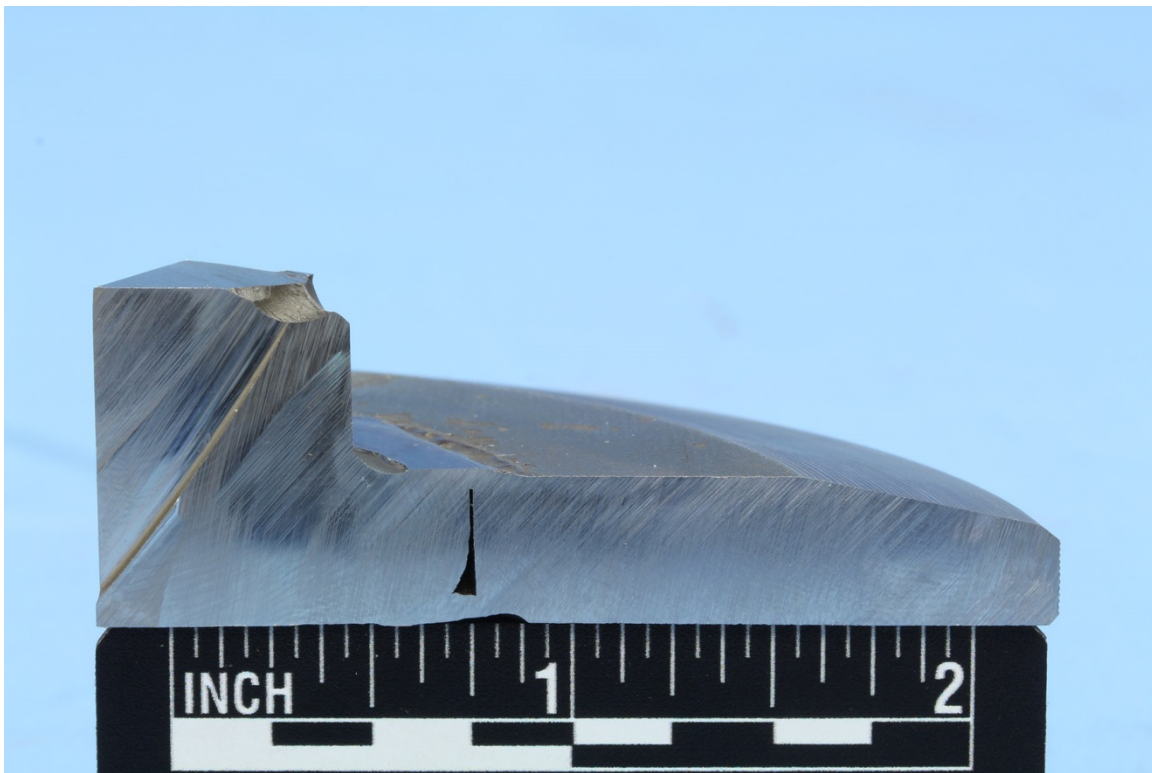


Figure 4: a) Image of the journal to cheek transition at the aft end of the number 2 main bearing journal; b) image of the journal to cheek transition at the forward end of the number 1 main bearing journal.



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b)

Figure 5: a) and b) Images of two sections through the counterweight forward of the number 2 main bearing journal.

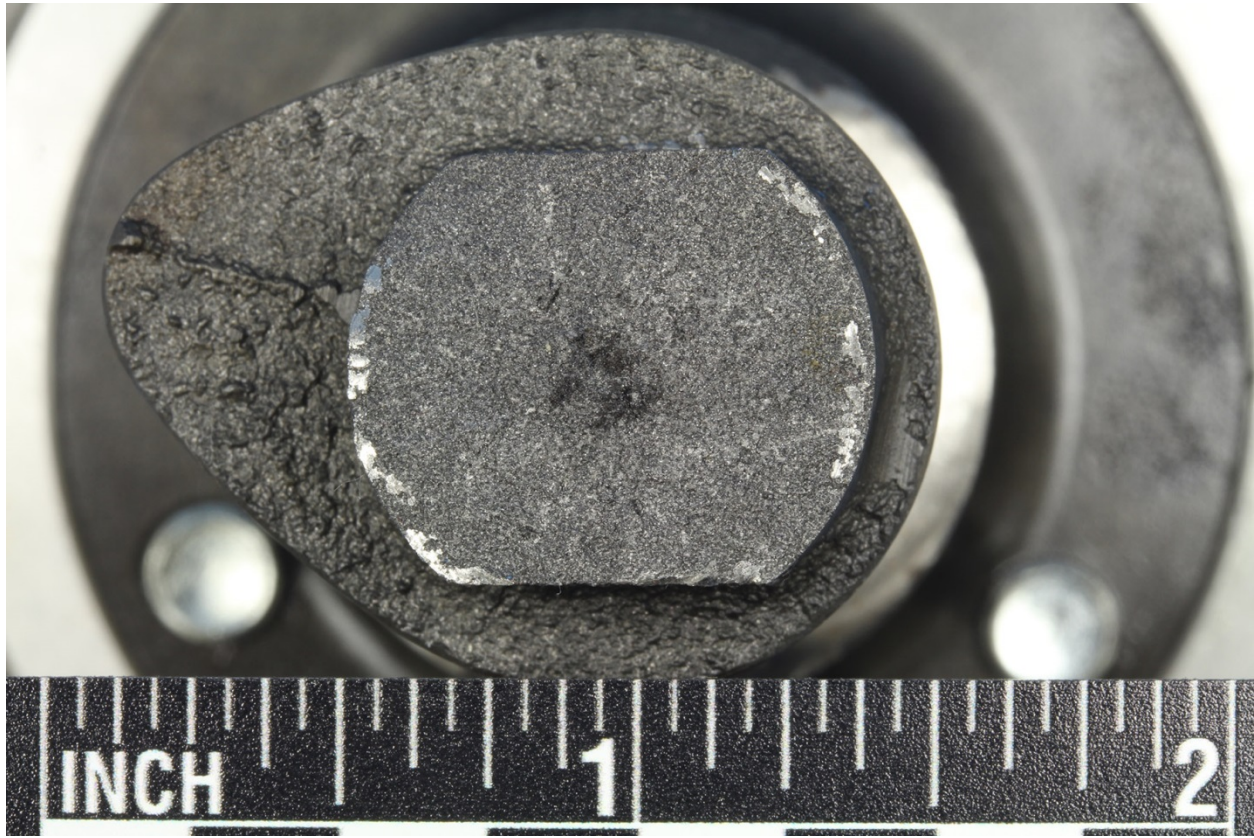


Figure 6: Image of the fracture through the camshaft forward of the number 1 lobe.